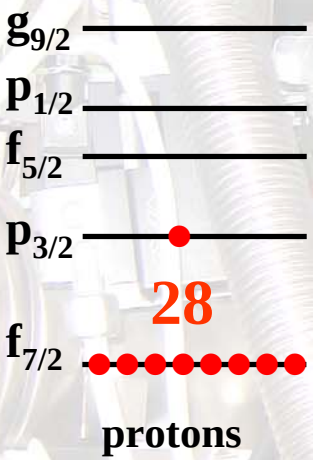
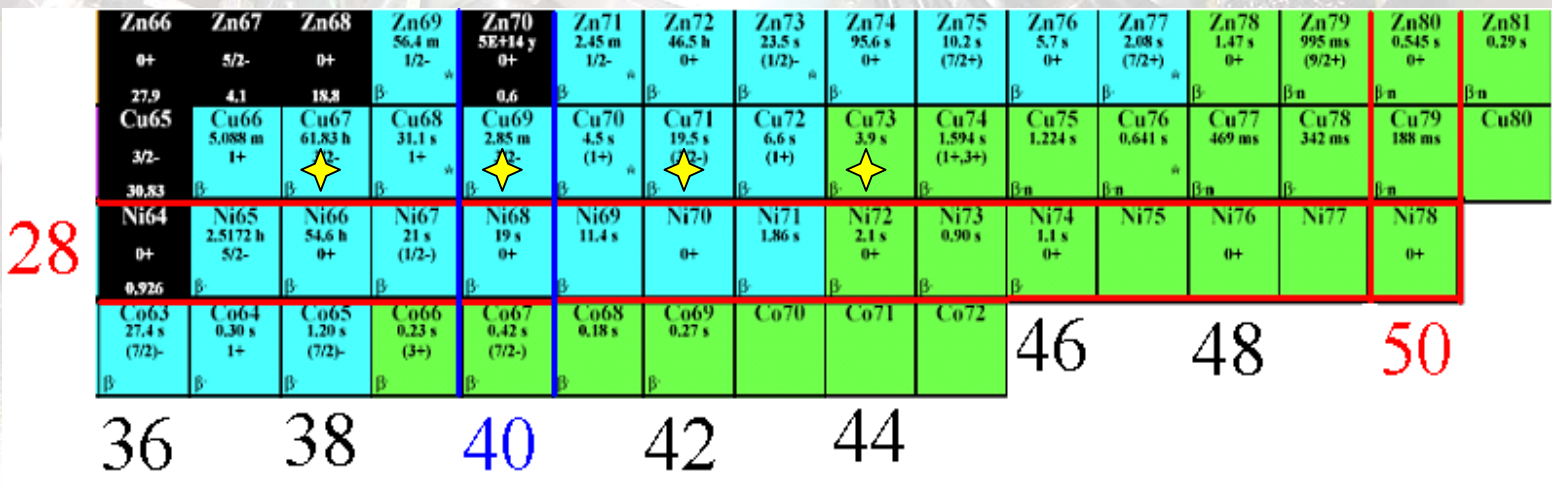
Coulomb excitation of the neutron-rich ^{67,69,71,73}Cu with Miniball and REX-ISOLDE

Irina Stefanescu

IKS, KULeuven

The neutron-rich odd-A Cu isotopes





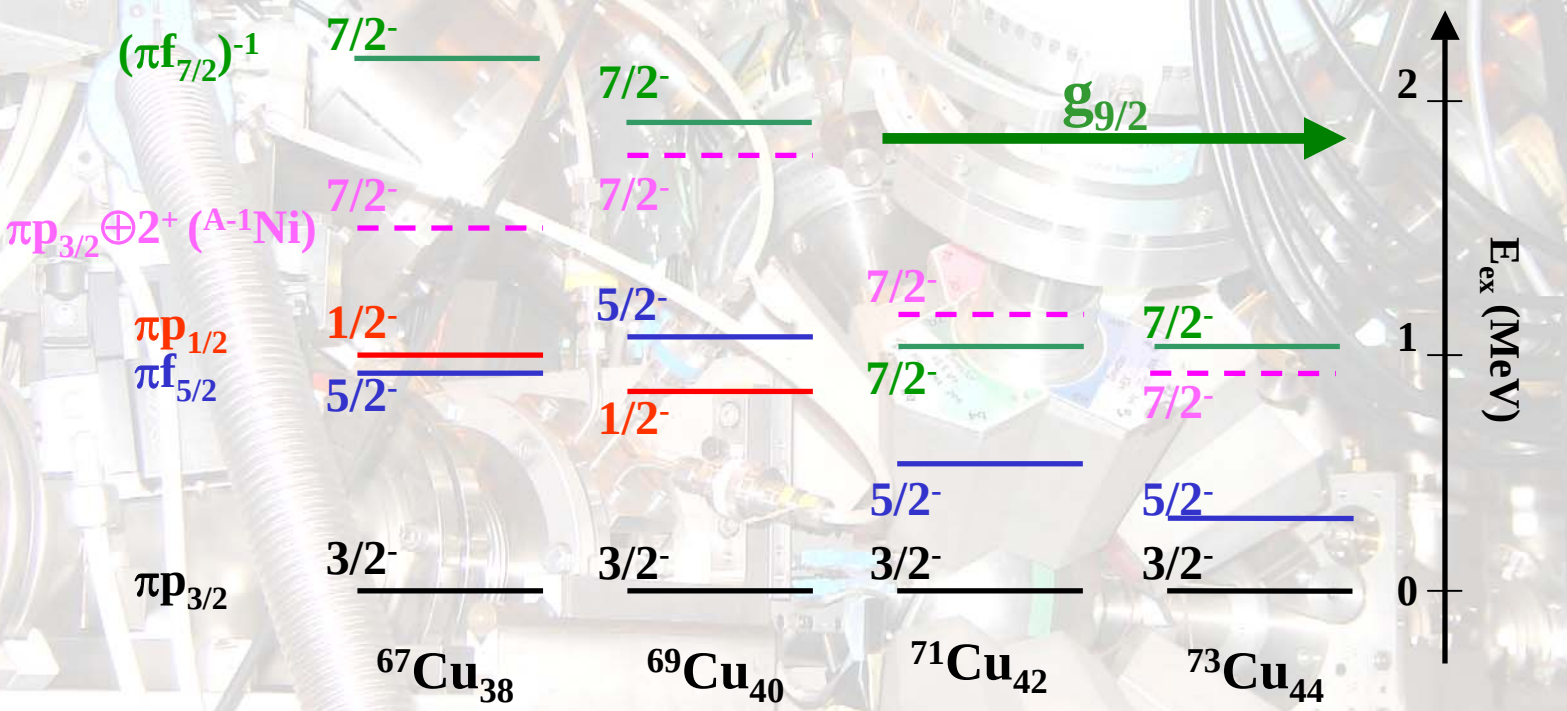
[67,69]Cu: (d,t) reaction: B. Zeidman et al., PRC 18, 2122(1978).

[69]Cu: T. Ishii et al., PRL 84, 39 (2000).

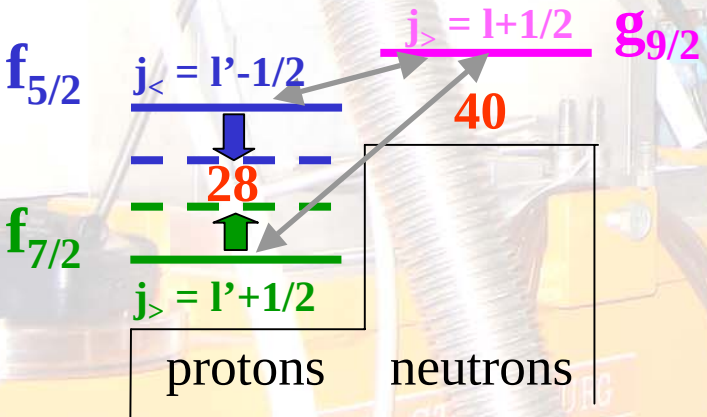
[71]Cu: (GANIL): R. Grzywacz et al., PRL 81, 766 (1998).

[69,71,73]Cu: (ISOL): S. Franchoo et al., PRL 81, 3100(1998).

^{67,69,71,73}Cu and the monopole migration



monopole interaction

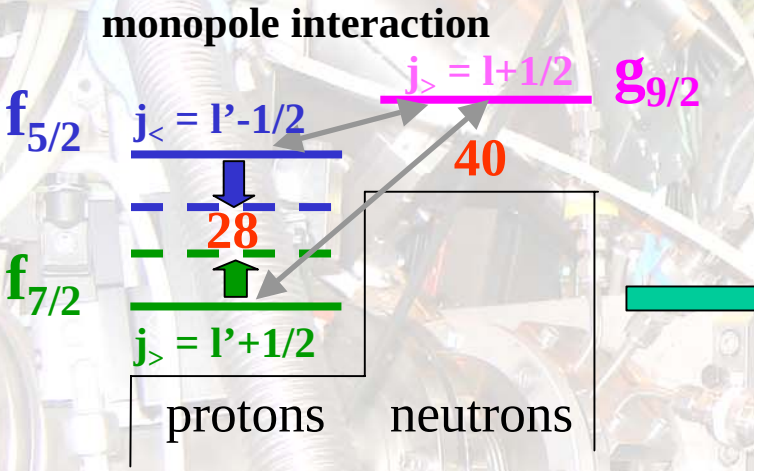


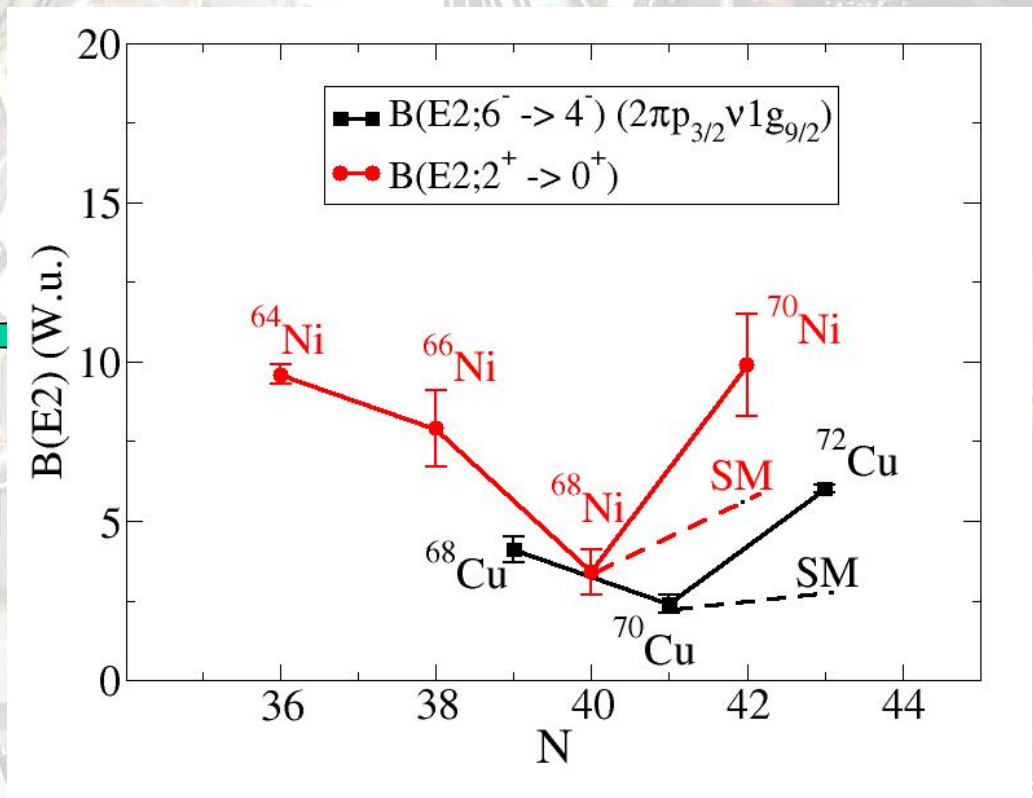
Shell-model: N. Smirnova et al., PRC 69, 044306(2004)

T. Otsuka et al., PRL 95, 232502 (2005).

PCM: A. M. Oros-Peusquens et al., NPA 669, 81(2000).

Monopole migration vs. magicity



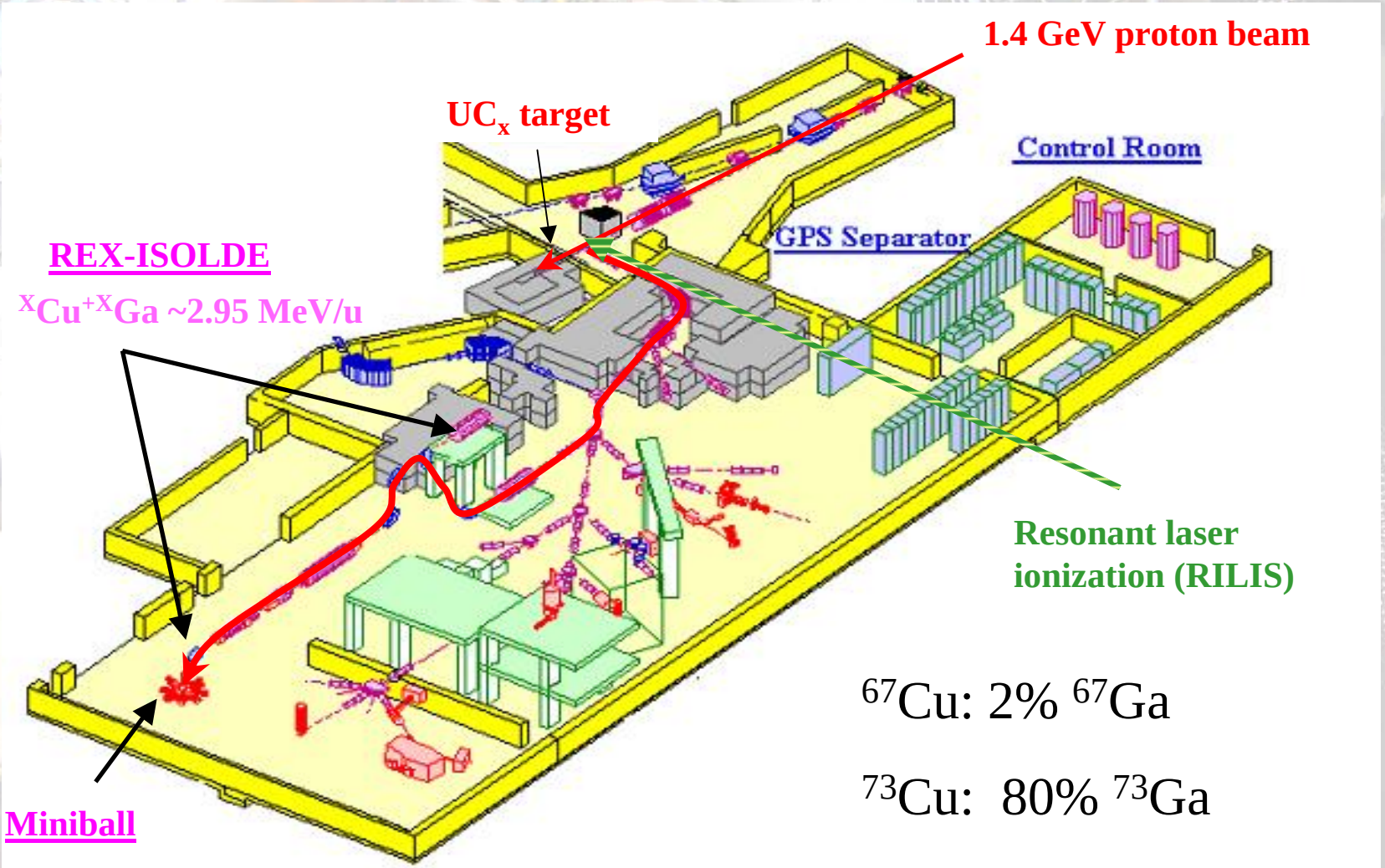


[66,68]Ni: O. Sorlin et al., PRL 88, 092501(2002); [70]Ni: O. Perru et al., PRL 96, 232501(2006).

[68,70]Cu: I. Stefanescu et al., submitted PRL; [72]Cu: R. Grzywacz et al., PRL 81, 766 (1998).

Coulex on 67,69,71,73Cu ➔ B(E2) values as a probe for the internal structure of the levels

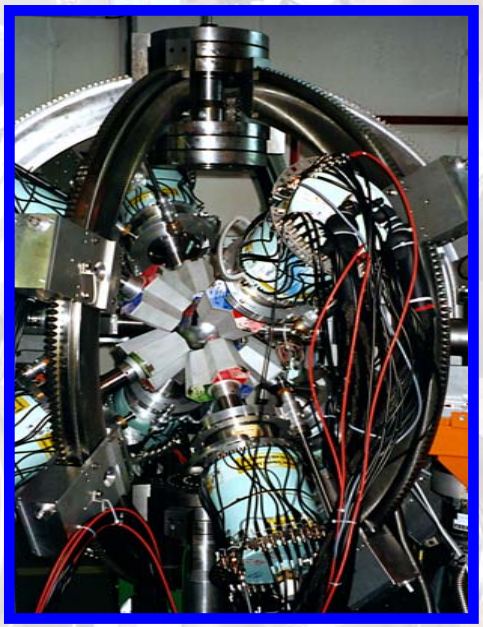
Radioactive beams of ^{67,69,71,73}Cu @ISOLDE



^{67}Cu: 2% ^{67}Ga

^{73}Cu: 80% ^{73}Ga

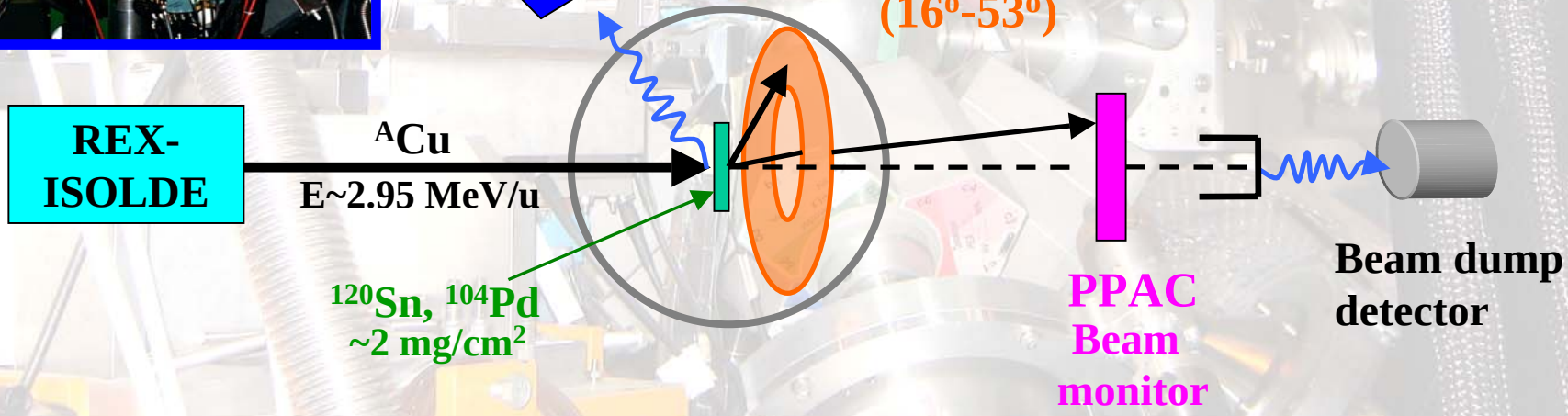
Experimental set-up for Coulex @REX-ISOLDE



Miniball

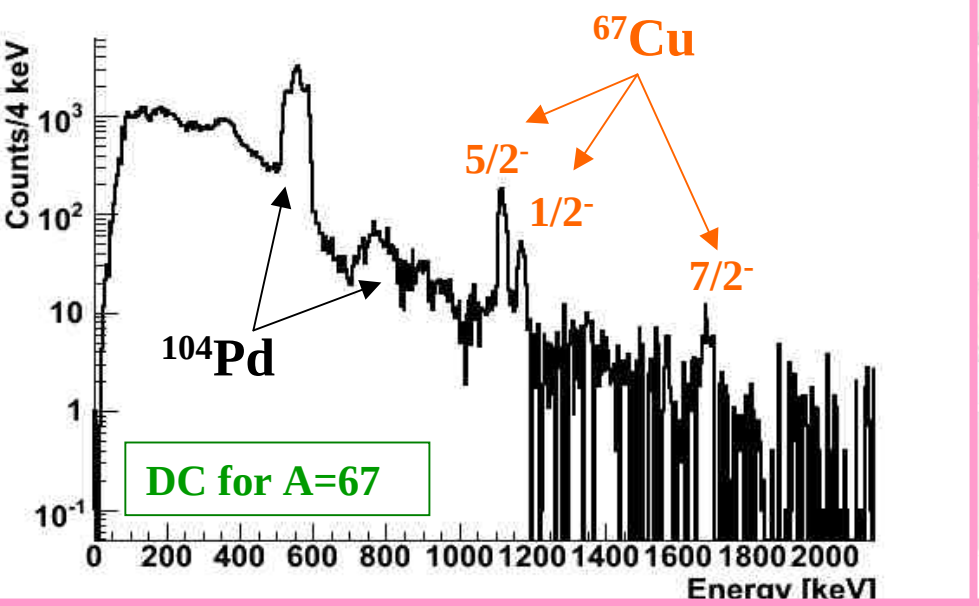
- 4 quadrants
- 16 annular strips (θ)
- 24 sector strips (ϕ)

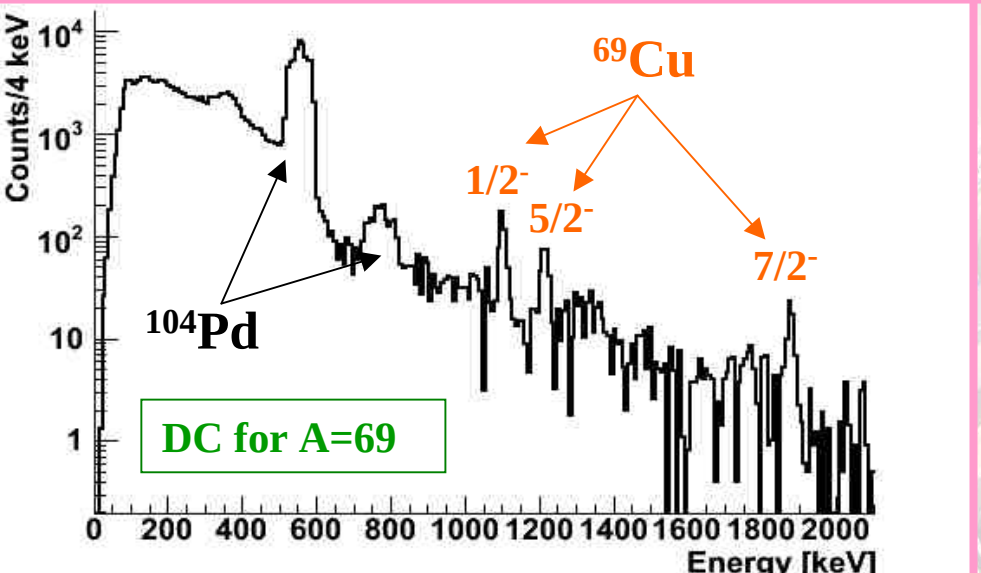
DSSD detector
(16º-53º)

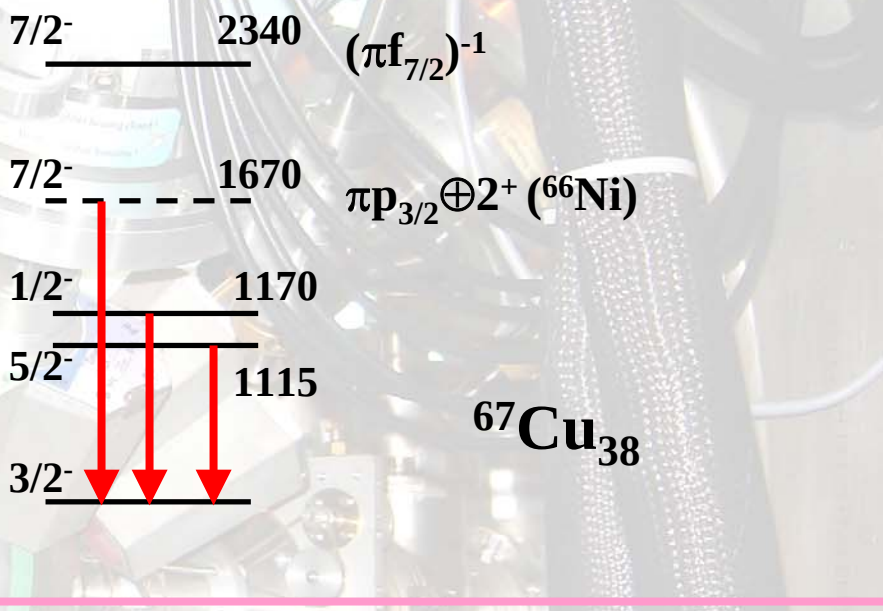


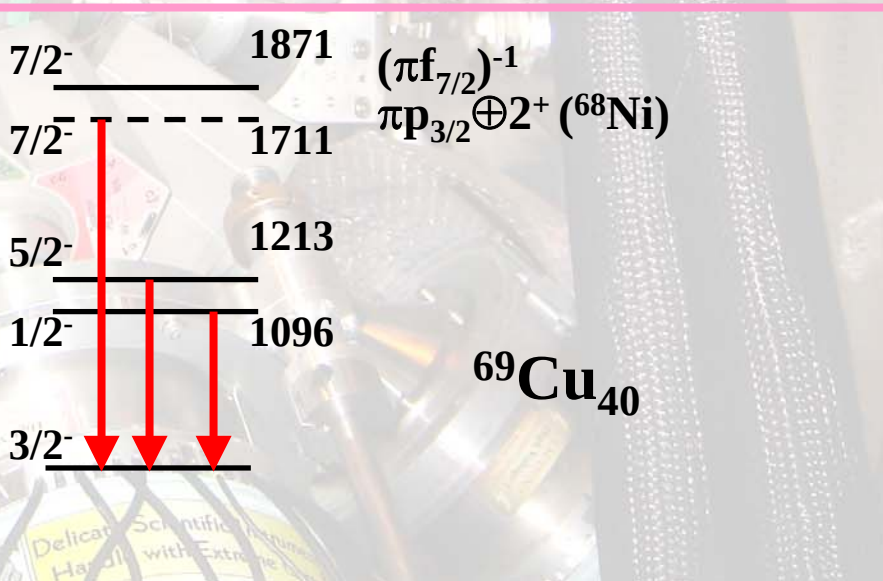
v/c ~ 7% ➔ Doppler correction of the γ-rays on an event-by-event mode by using the segmentation of the particle and γ-detectors.

Experimental results (1)

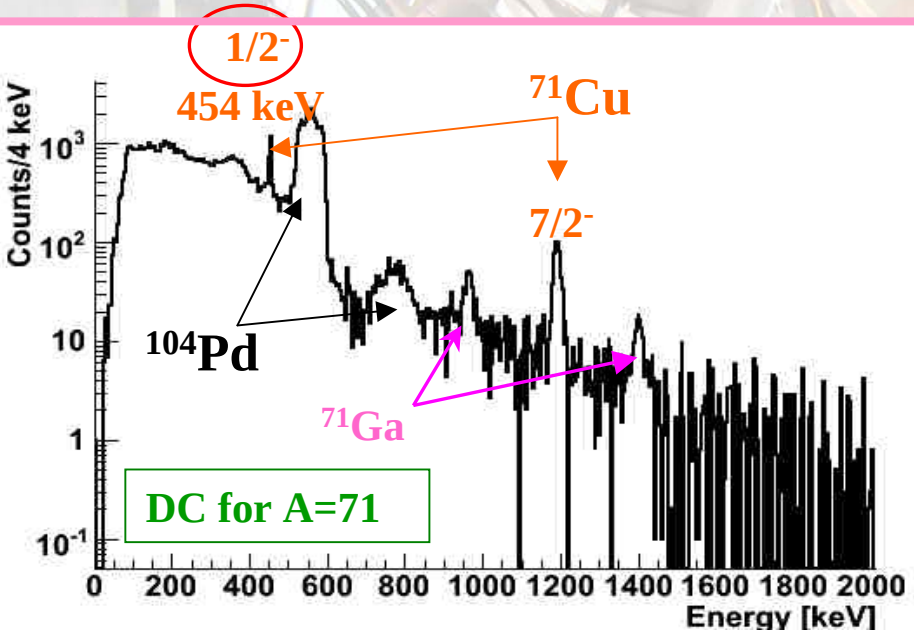


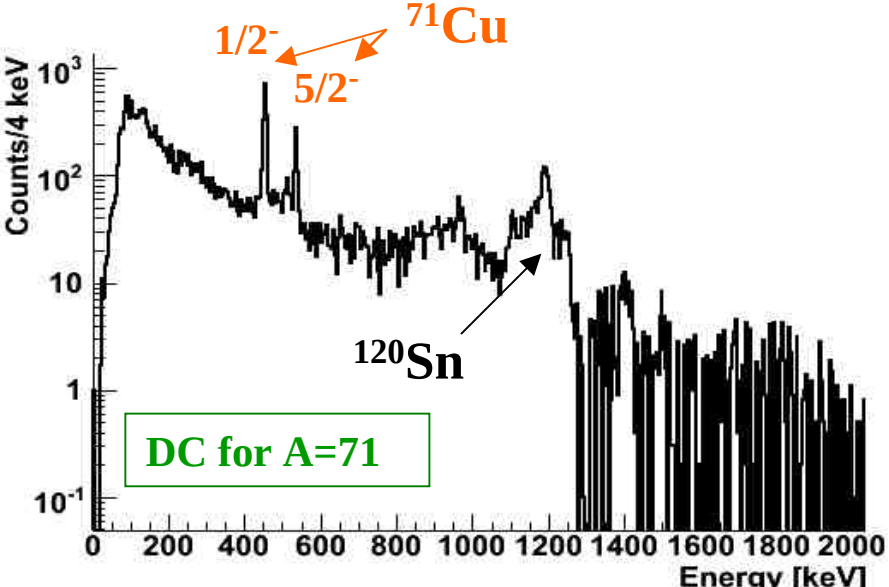


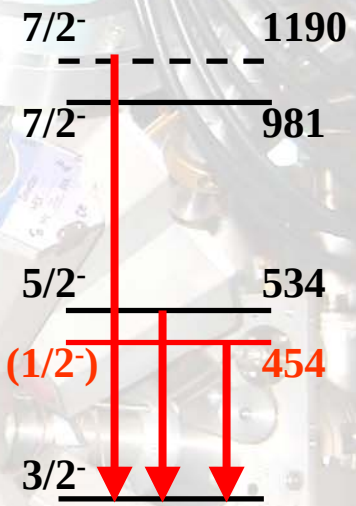




Experimental results (2)





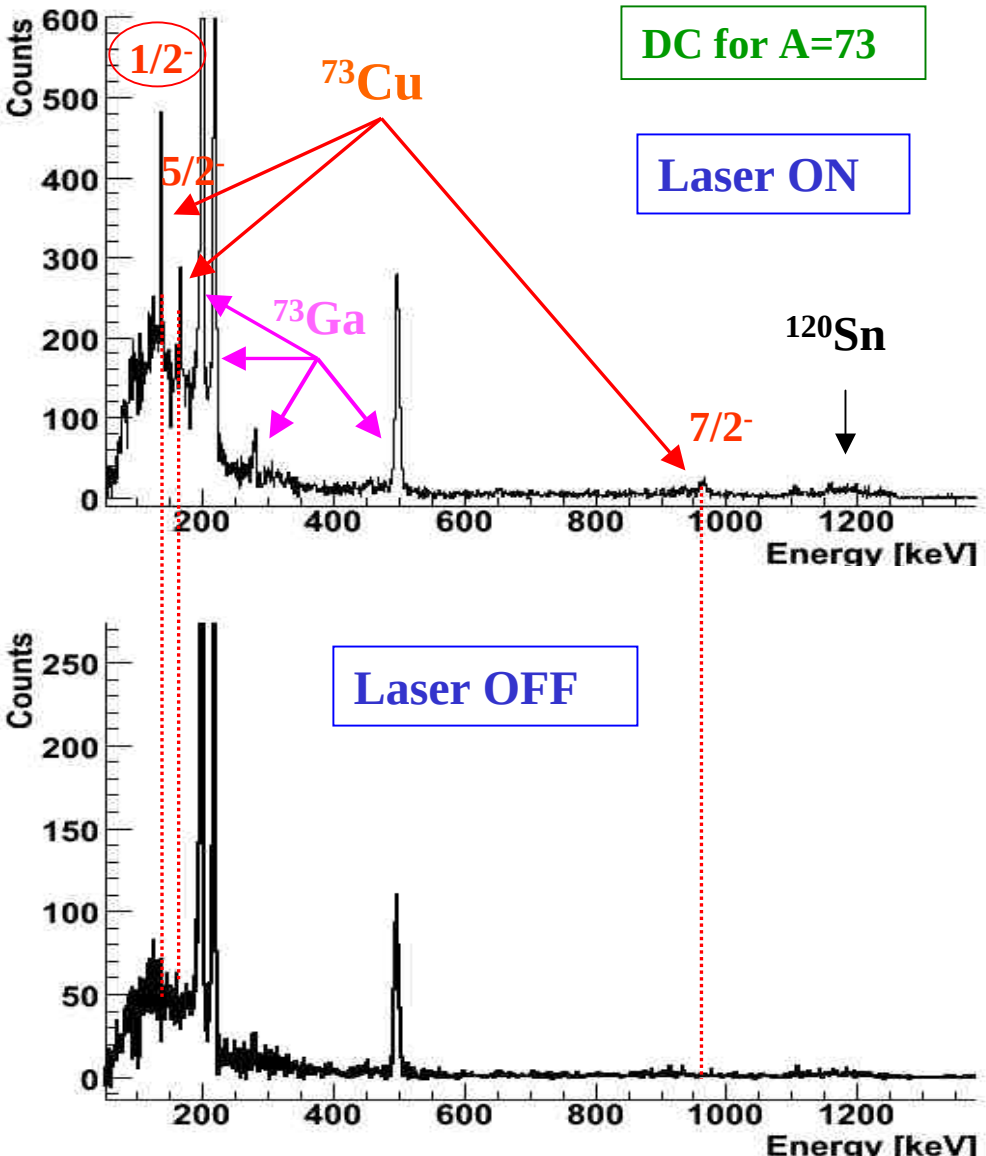


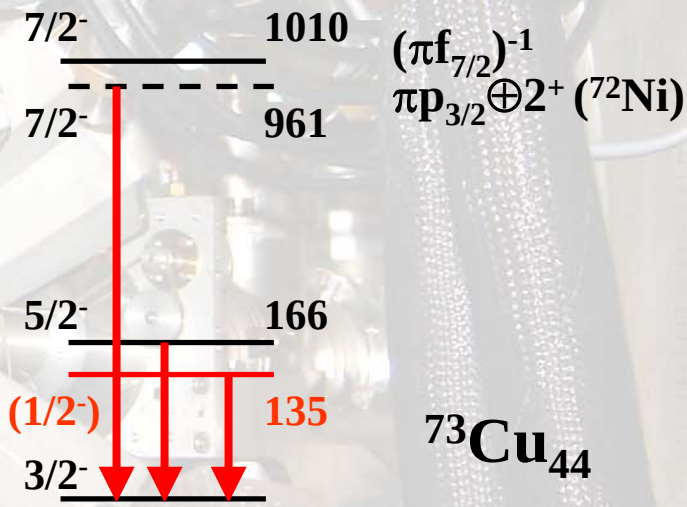
$\pi p_{3/2} \oplus 2^+$ (^{72}Ni)

$(\pi f_{7/2})^{-1}$

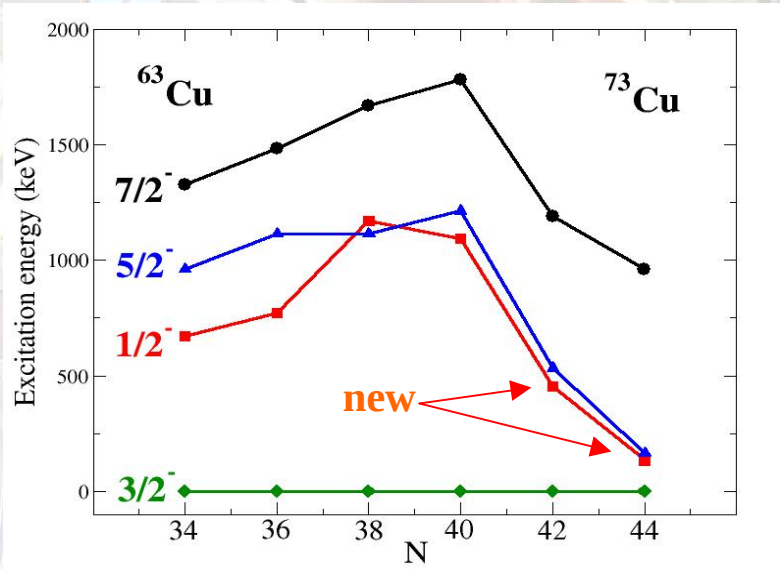
$^{71}Cu_{42}$

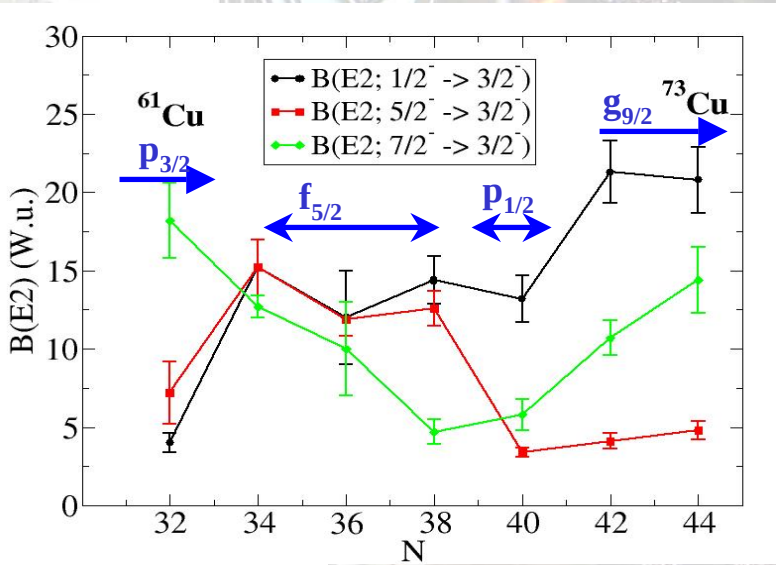
Experimental results (3)

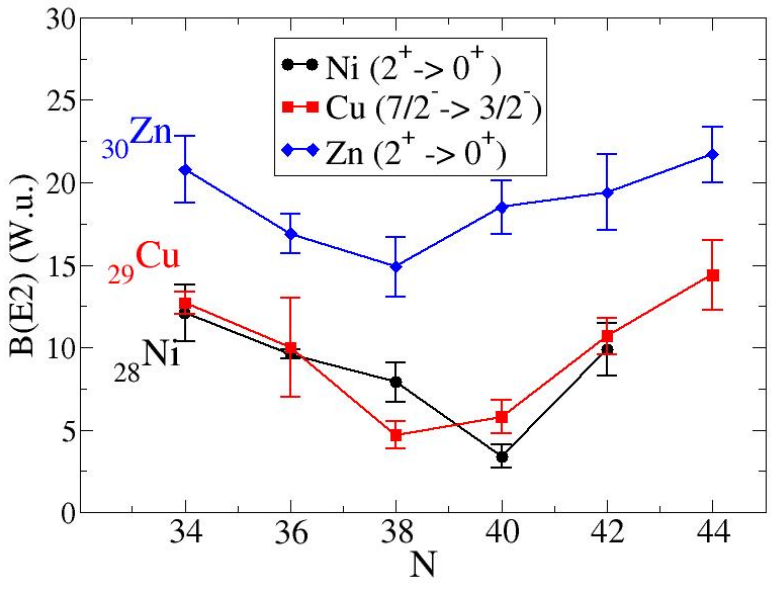




Experimental results (preliminary)







Conclusion and outlook

✓ **Summer 2006 ➔ Coulex of ^{67,69,71,73}Cu**

✓ **$\frac{1}{2}^-$ identified in ^{71,73}Cu**

✓ **three B(E2) values measured in each isotope**

➢ **low collectivity for $5/2^-$ and high collectivity for $1/2^-$ states beyond N=40**

➢ **adding a proton to the ^{68}Ni core shifts the minimum from N=40 in the even-even Ni isotopes to N=38 in the odd-A Cu isotopes, similar to the even-even Zn isotopes**

➢ **Summer 2007 ➔ Coulex of ^{72,75}Cu**

The collaboration

IKS Leuven: O. Ivanov, J. Van de Walle, N. Bree, N. Patronis, M. Huyse, P. Van Duppen

CSNSM Orsay: G. Georgiev

IPN Orsay: S. Franchoo

IKP Köln: N. Warr, A. Blazhev, P. Reiter, J. Jolie

TU München: T. Kröll, T. Behrens, R. Krücken

Warsaw University: J. Iwanicki

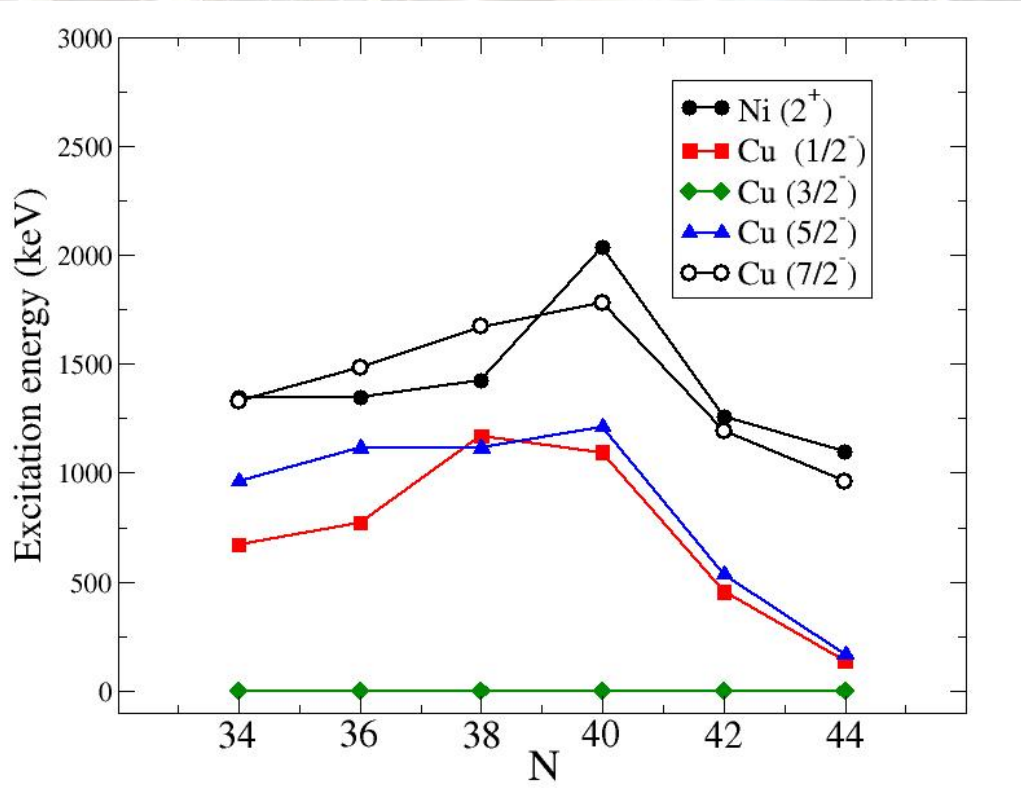
National Research Center Demokritos, Greece: S. Harissopulos, A. Lagoyannis

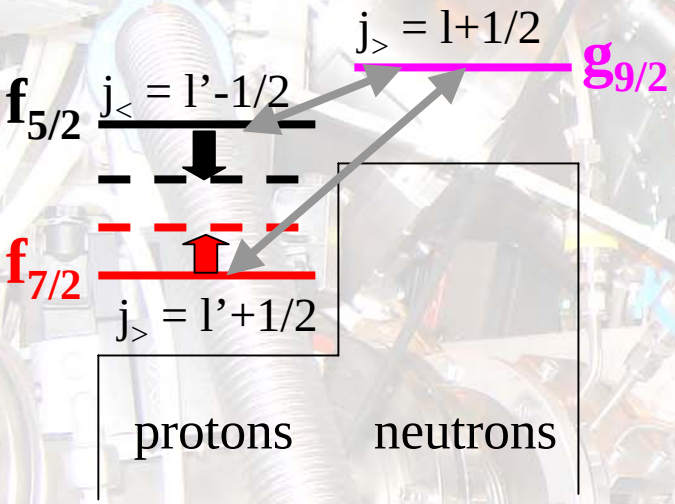
Universita di Camerino: G. Lo Bianco, D. Balabanski

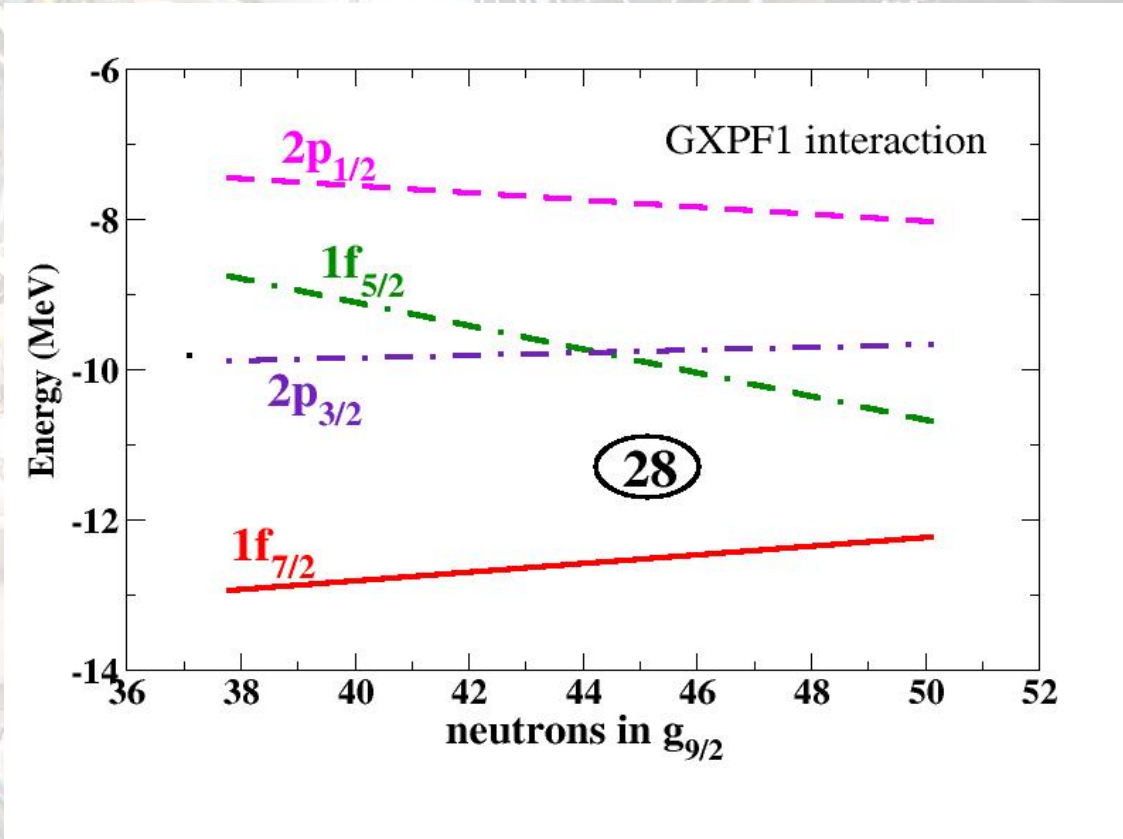
University of Liverpool: P. Butler

Universiteit Ghent: K. Heyde, N. Smirnova, A. De Maesschalck

CERN: D. Voulot, F. Wenander, V. Fedoseev, L.M. Fraile, Isolde collaboration


Excitation energy (keV)
3000
2500
2000
1500
1000
500
0
34
36
38
40
42
44
N
Ni (2+)
Cu (1/2-)
Cu (3/2-)
Cu (5/2-)
Cu (7/2-)


$j_> = l+1/2$
$g_{9/2}$
$f_{5/2}$
$j_< = l'-1/2$
$f_{7/2}$
$j_> = l'+1/2$
protons
neutrons


GXPF1 interaction
$2p_{1/2}$
$1f_{5/2}$
$2p_{3/2}$
28
$1f_{7/2}$
Energy (MeV)
-6
-8
-10
-12
-14
36
38
40
42
44
46
48
50
52
neutrons in $g_{9/2}$